Charged Hadron Production in d+Au, p+Au, and n+Au Collisions

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PH✴ENIX

Zvi Citron

zcitron@skipper.physics.sunysb.edu

We present transverse momentum p_T spectra of charged hadrons measured in deuteron-gold and nucleon-gold collisions in the PHENIX experiment at $\sqrt{s_{NN}}=200$ for four centrality classes. Nucleon-gold collisions were selected by tagging events in which a spectator nucleon was observed in one of two forward rapidity detectors. The spectra and yields were investigated as a function of the number of binary nucleon-nucleon collisions, ν, suffered by deuteron nucleons. A comparison of charged particle yields to those in p+p collisions show that yield per nucleon-nucleon collision saturates with ν for high momentum particles. We also present the charged hadron to neutral pion ratios as a function of p_T.

Single Nucleon Collision Tagging


n → ZDC

p Au
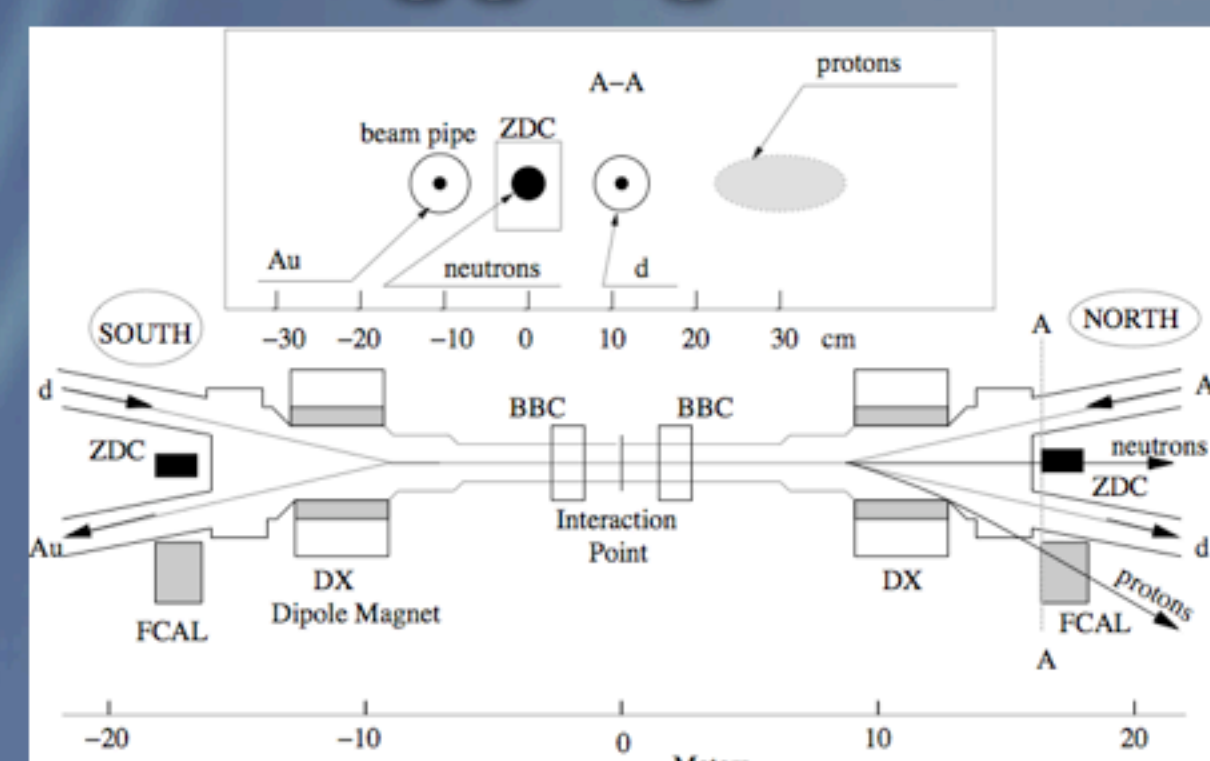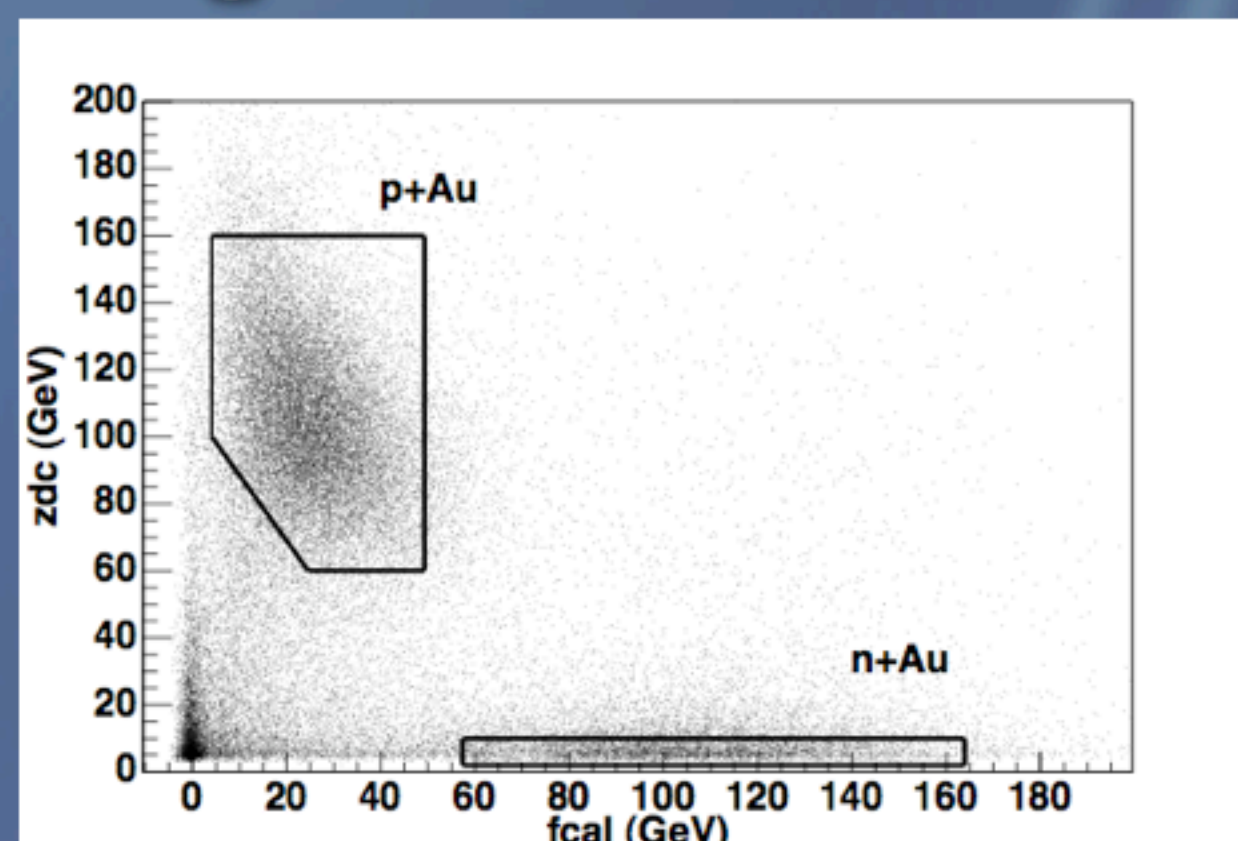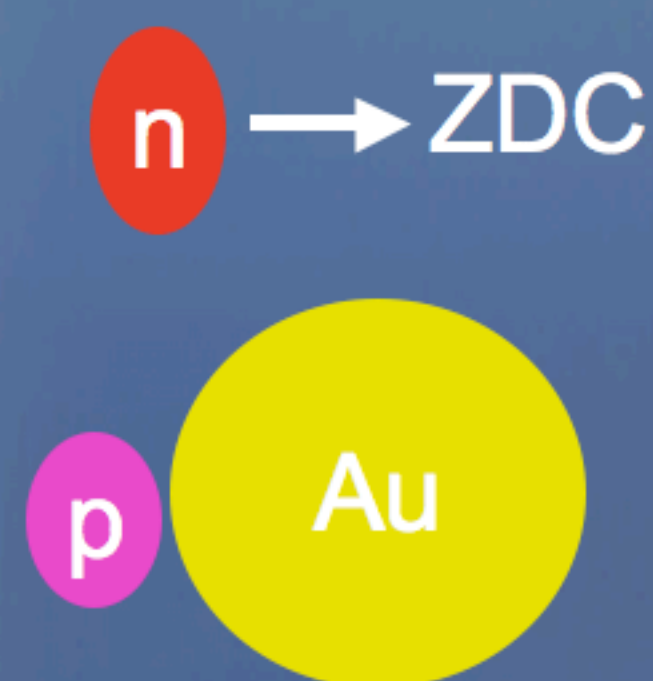
Deuteron spectator tagging in PHENIX

We use signals in the forward detectors to select events in which only one of the two deutron nucleons interacts with the Au. p+Au and n+Au events are combined to form a single N+Au dataset.

n Au

p → FCAL
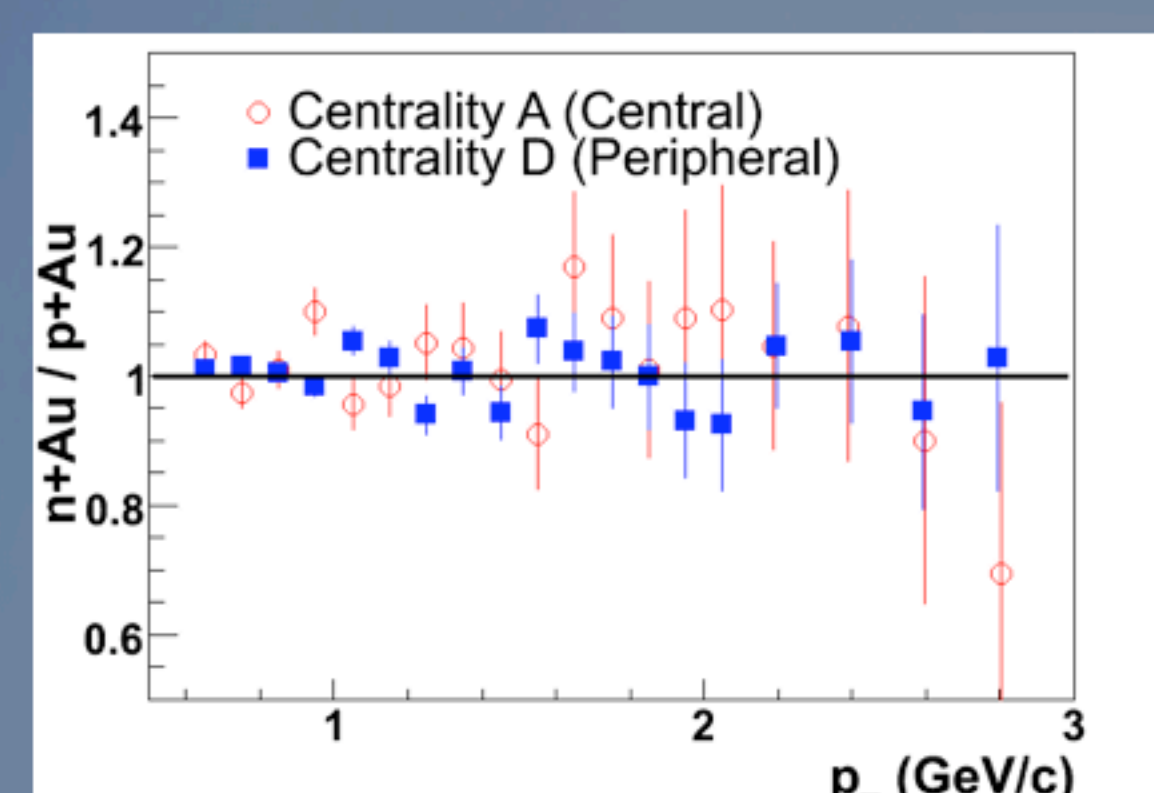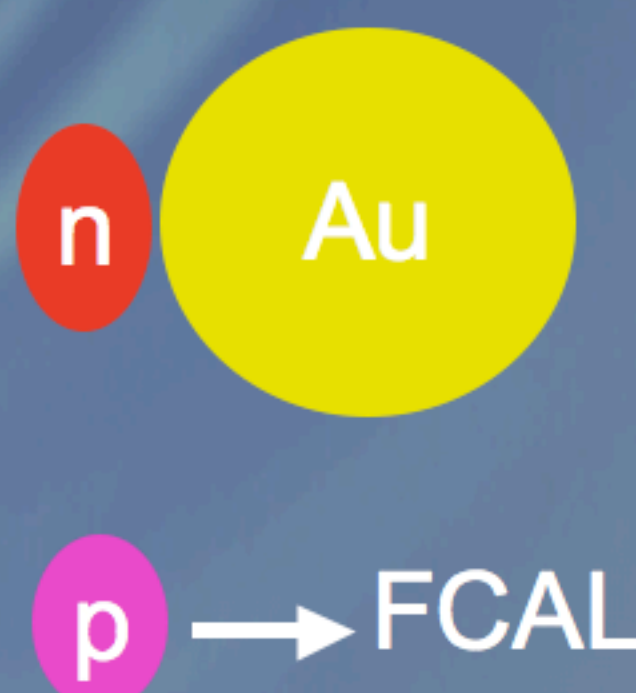
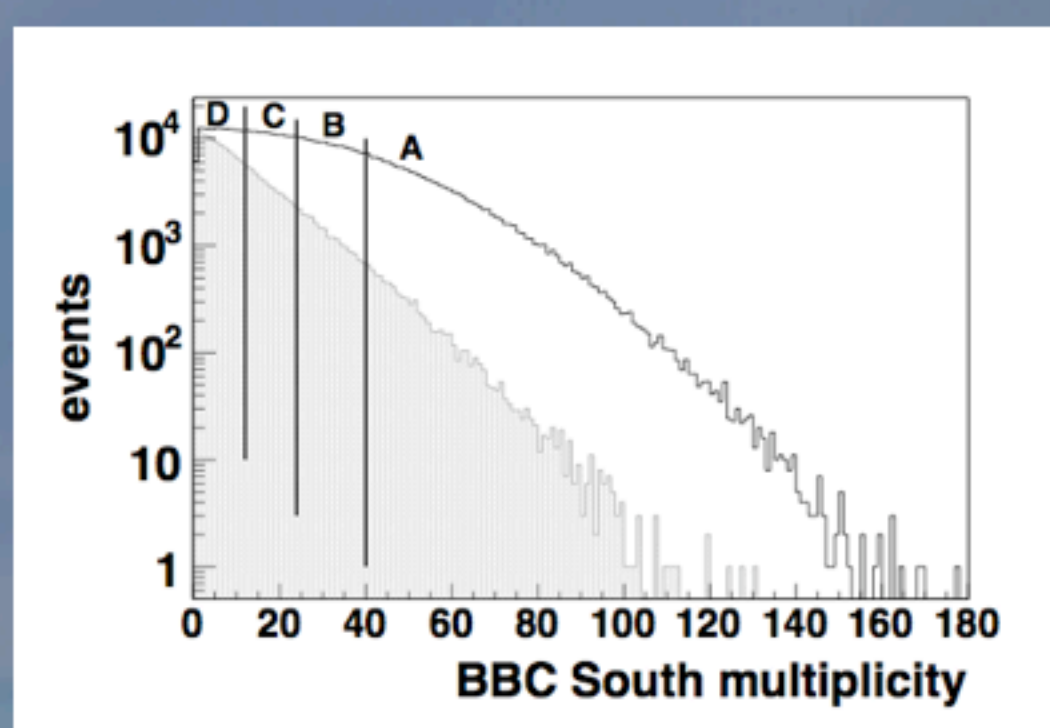Ratio of invariant per collision yields from n+Au and p+Au

Hadron Analysis

• Background from conversion electrons, and secondarily produced hadrons subtracted

• Monte Carlo correction to address acceptance, reconstruction efficiency, and momentum resolution
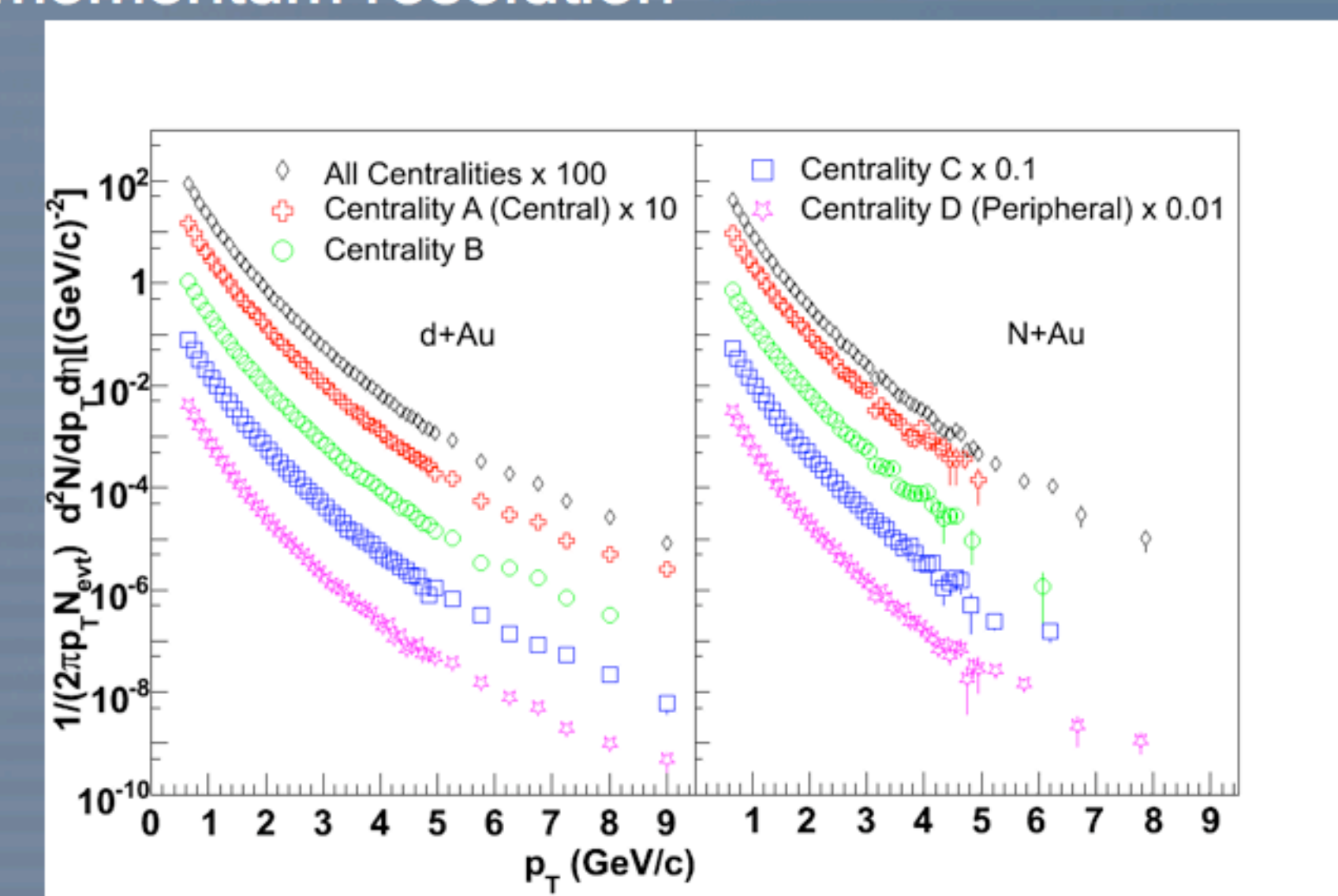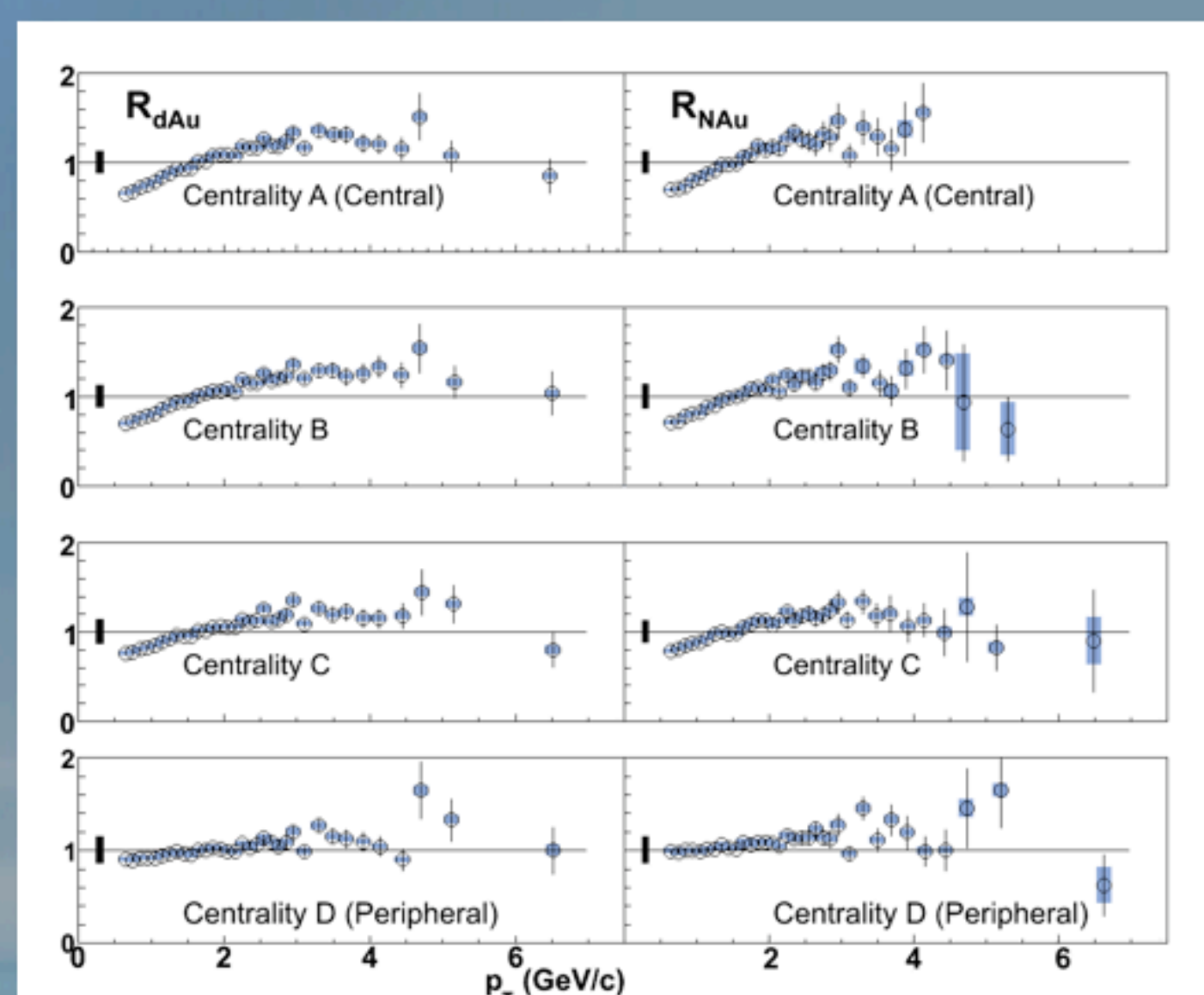

Invariant yield per collision

Centrality Selection with BBC

We use the South Beam Beam Counter response to define four centrality classes.

[1] S. S. Adler et al., Phys. Rev. Lett. 95, 202001(2005)

[2] S.S. Adler et al., Phys. Rev. Lett. 98, 172302 (2007)

[3] S.S. Adler et al., Phys. Rev. C74, 024904(2006)

[4] B. Alper et al. [British-Scandinavian Collaboration], Nucl. Phys. B100, 237(1975)

Cronin Effect

$$R_{AB}(p_T) = \frac{(1/N_{evt})d^2N^{A+B}/dp_Td\eta}{<T_{AB}>d^2\sigma^{p+p}/dp_Td\eta}$$

Nuclear modification factor for d+Au and N+Au collisions. PHENIX p+p reference from [1].
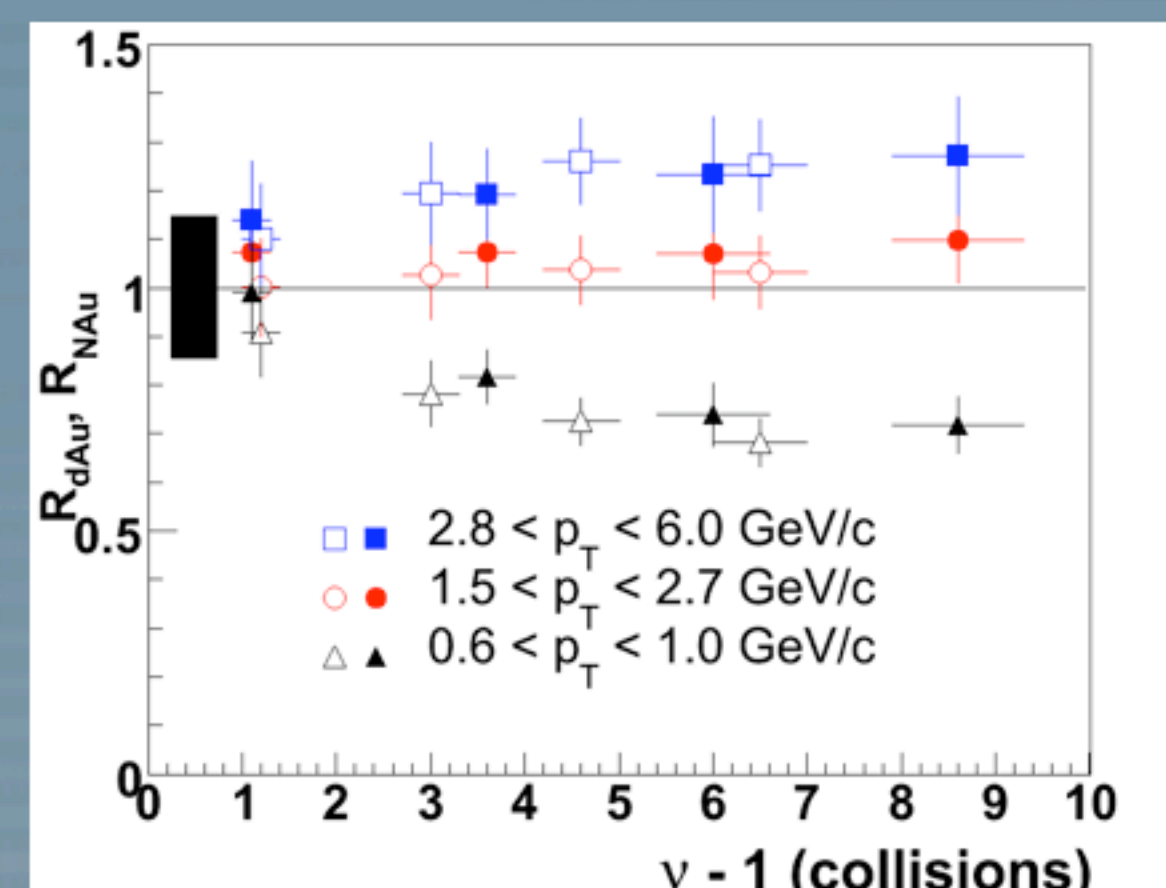
The nuclear modification factor averaged in three momentum regions, as a function of additional scatterings per deuteron participating nucleon, ν-1. Open symbols for d+Au and closed for N+Au. ν-1 independence implies single additional scattering causes the enhancement.
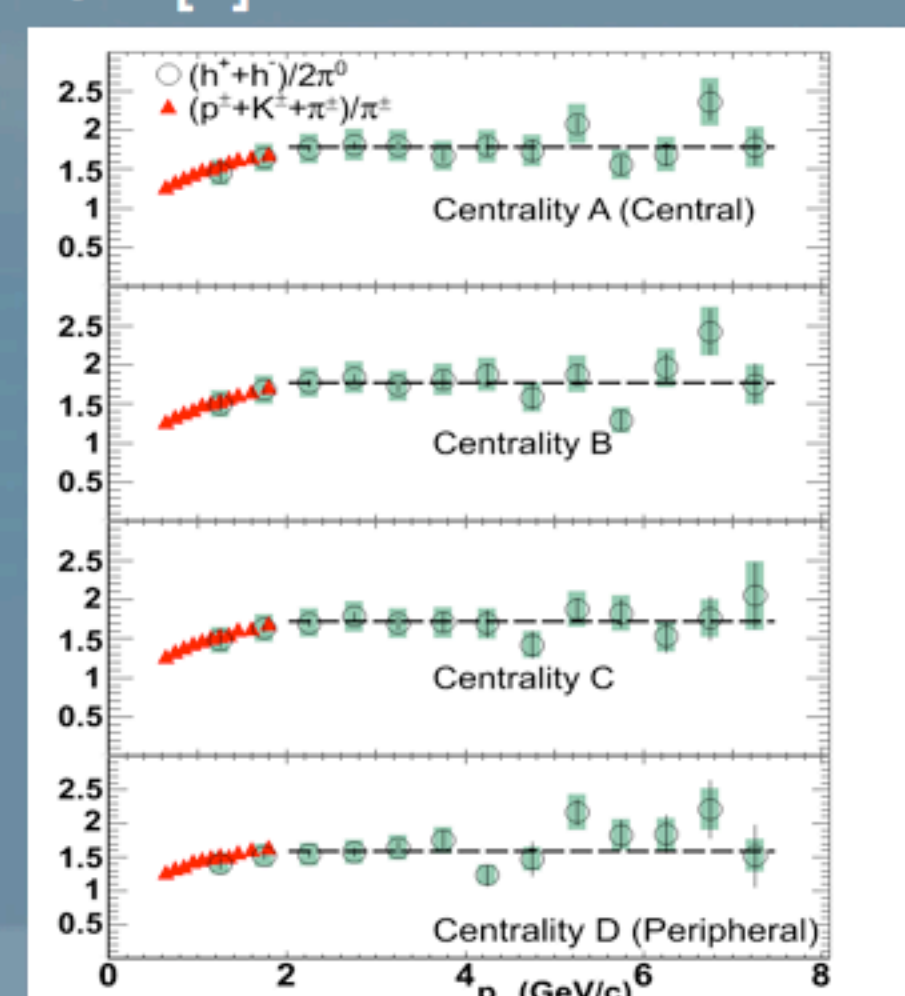
Charged h/π^0 ratio shown with circles (π^0 from [2]). Triangles are from the identified charged particle analysis [3]. The ratio increases with centrality implying some modification relative to low energy collisions which match the most peripheral collisons [4].

Conclusions

• The hadron yields in p+Au and n+Au collisions are identical within our experimental uncertainty.

• Within this analysis and its experimental uncertainty, there is no difference between R_{dA} and R_{NA}.

• An excess of hadron production is seen at $p_T > 2$ GeV/c, consistent with enhancement due to the Cronin effect.

• The magnitude of the Cronin effect is independent of the number of additional scatterings (ν -1) within the limits of our uncertainties.

• We found that the charged pions account for about 60% of the charged hadrons at $p_T > 3$ GeV/c, with a slightly larger value in central d+Au collisions. This implies that R_{dA} for protons and kaons remains close to one at higher p_T.